

# 國立彰化師範大學 99 學年度碩士班招生考試試題

系所：電機工程學系

科目：工程數學

☆☆請在答案紙上作答☆☆ (寫出過程)

共 2 頁，第 1 頁

I. (20%) Find the general solutions of the following differential equations.

(a)  $y''+4y'+4y = xe^x$  (10%)

(b)  $x^3y'''+3x^2y''-2xy'+2y = 0$  (10%)

II. (10%) Use Laplace transform to solve the differential equation.

$$y''+2y'+y = 2\cos t, \quad y(0) = 3, \quad y'(0) = 0$$

III. (10%) Solve the following integral equation.

$$y(t) = t + \int_0^t \sin(t-\tau)y(\tau) \cdot d\tau$$

IV. (10%) Find the Fourier series of a periodic function defined as

$$f(t) = \begin{cases} 0, & -\frac{\pi}{\omega} < t \leq 0 \\ 2\sin(\omega t), & 0 < t \leq \frac{\pi}{\omega} \end{cases}, \quad f\left(t + \frac{2\pi}{\omega}\right) = f(t).$$

V. (10%) The Fourier transform of  $x(t)$  is shown in *Figure 1*. Please find the following quantities without explicitly computing  $x(t)$ .

(a)  $x(0)$  (5%)

(b)  $\int_{-\infty}^{\infty} x(t)dt$  (5%)

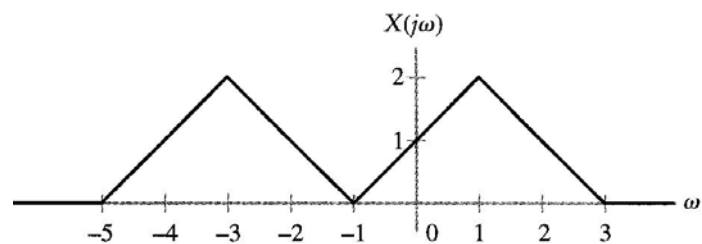


Figure 1

VI. (20%) Evaluate the following integrals by means of the residue theorem

(a)  $\oint_C \frac{e^{2z}}{(z-i)^2} dz, \quad C: |z|=2$  (5%)

(b)  $\oint_C \frac{\sin z}{(z-\pi)^3} dz, \quad C: |z|=2$  (5%)

(c)  $\frac{1}{2\pi i} \oint_C \frac{1}{z(z^6-1)(z+3)} dz, \quad C: |z|=2$  (10%)

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VII. (10%) If  $\vec{F} = (2y + z)\vec{a}_x + (y - 2)\vec{a}_y + (3y - x)\vec{a}_z$ , evaluate the integral  $\oiint_S \vec{F} \cdot d\vec{s}$  over the closed surface of the cube bounded by  $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ ,  $0 \leq z \leq 1$ .

VIII.(10%) If  $\vec{A} = 3\vec{a}_\rho + 2\vec{a}_\phi + 5\vec{a}_z$  and  $\vec{B} = -2\vec{a}_\rho + 3\vec{a}_\phi - \vec{a}_z$  are given at points P(3, 30°, 5) and Q(4, 60°, 3), respectively, find  $\vec{C} = \vec{A} + \vec{B}$  at point S(2, 45°, 4) expressed in cylindrical coordinates.